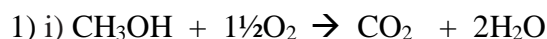


ANSWERS: Crystal ball: Calorimetry calculations



ii) mass of water = 12g (as 1m of water = 1g)

change in temperature of the water is 35 °C

$$\text{Heat of reaction} = 12 \times 4.18 \times 35 = 1755.6\text{J}$$

1 mole of methanol = 32 g

$$? \text{ moles} = 2\text{g} = 2/32 = 0.0625\text{moles}$$

$$0.0625 \text{ moles of methanol} = 1755.6\text{J}$$

$$\text{so 1 mole of methanol} = 1755.6/0.0625 = 28089.6\text{J} = 28.089\text{kJ} \text{ (28.1J to 3 sig figs)}$$

2) i) 1 mole H_2O = 18g

To melt 1 mole of water 8.03 kJ are required

$$\text{number of moles of } \text{H}_2\text{O} \text{ in } 350\text{g is} = 350/18 = 19.44$$

$$\begin{aligned} \text{Energy required to melt } 350\text{g of water is } 19.44 \times 8.03\text{kJ} \\ = 156.138\text{kJ} \end{aligned}$$

ii) 1 mole of butane releases 2874 kJ

$$? \text{ moles of butane releases } 156.138\text{kJ of energy} = 156.138/2874 = 0.05432 \text{ moles required}$$

$$\text{iii) } \Delta H = m \times c \times \Delta T$$

$$= 350 \times 4.18 \times 90$$

$$= 131.670\text{kJ energy needed to heat the ice to hot water}$$

1 mole of butane releases 2874 kJ of energy

$$\text{moles of butane required is } 131.670/2874 = 0.0458141\text{kJ}$$

remembering to add on the moles of butane required to melt the ice from part ii) 0.05432

therefore, total moles of butane required is 0.100134kJ

$$\text{mass of butane required} = 58 \times 0.100134 = 5.80778\text{g}$$

3) i) The mass of water is 75g as 1mL of water is approximately equal to 1g

$$\text{density} = \text{mass/volume so mass of NaOH is } 1.2191 \times 25 = 30.4775$$

$$\text{total mass of water and NaOH is } 105.4775\text{g}$$

$$\text{change in temperature } (\Delta T) = 27 - 20 = 7^\circ\text{C}$$

$$\text{Heat of reaction} = 105.4775 \times 4.18 \times 7 = 3086.27\text{J or } 3.086\text{kJ (round up as } 3.09\text{kJ)}$$

ii) 25mL of 20% w/v NaOH solution

20g of NaOH per 100mL H_2O , so in 25mL solution there is 5g of NaOH

$$\text{number of moles of NaOH is } 5/40 = 0.125 \text{ moles}$$

$$\text{So, the enthalpy change would be } 3.08627/0.125 = 24.690\text{kJmol}^{-1}$$

$$4) \text{ Heat of reaction} = 4\text{kJ} = 4000\text{J} = \text{mass of water} \times 4.18 \times 65$$

$$\text{so, mass of water is } 4000/(4.18 \times 65)$$

= 14.7g of water (assuming that 1mL of water equals 1 g of water, also you'll notice that the value of 5g for the mass of ethanol is not required for this calculation)